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Demographic shift and changing landscape of Nepal: migration, population redistribution, and land use transitions

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Abstract

Nepal is currently undergoing a profound demographic shift fueled by declining fertility, reduced mortality, and high levels of out-migration. These demographic factors have caused a massive redistribution of the population and significant changes in land use across the country's ecological regions. While the total population expanded from 11.56 million in 1971 to 29.16 million in 2021, the annual growth rate slowed dramatically from 2.62% to 0.92%. The Mountain and Hill regions have lost their proportionate population share. In contrast, the Tarai has become the dominant region, containing 53.6% of the national population as of 2021. The absentee population grew from 0.76 million in 2001 to 4.46 million in 2021, now making up 15.3% of the total population. This migration-led economy is evidenced by remittances, which account for 25.9% of Nepal's GDP. Migration has led to increased forest cover in the Hill and Siwalik zones, even as national cropland decreased from 26.3% to 24.2% between 2000 and 2019. The average agricultural landholding size dropped from 1.1 ha (1995/96) to 0.4 ha (2022/23), while the share of agricultural households fell from 73.9% to 60.3%. While Nepal has entered a demographic dividend window, it faces the dual crises of depopulating uplands and intensifying land fragmentation. This study highlights the urgent need for integrated policies that address these demographic transitions and ensure sustainable land management across all ecological zones.

Key Words: Demographic shift, Population redistribution, Migration, Land use change, Nepal

1. Introduction

Nepal, a country of the Himalayas, currently stands at the peak of its demographic dividend window facing the dual crises of depopulating uplands and intensifying land fragmentation. The country has undergone with massive rural out migration combined with declining fertility and mortality with subsequent changes in the age structure. This demographic shift which is not uniform in all the three ecological zones: Mountain, Hill and Tarai, has witnessed impact on land use change by these zones as well as by the urban and rural areas of the country. The population of Nepal had rapid growth trend until 2001 as per the population census result. From 2001 onward, the declining rate of population growth was observed. Over the past two decades, large-scale out-migration from Nepal's rural areas of mountain and Hill has become increasingly noticeable, leading to significant social and economic challenges. A substantial portion of those

leaving rural areas have migrated to larger cities and, notably, for foreign labor opportunities (Khatiwada, 2014) or even in the Tarai region. The 2001 census recorded an absent population of 762,181 (NSO, 2002); which increased by double in 2011 with 1,921,494 individuals representing 7.3% of the total population (NSO, 2012). Approximately one in every four households in Nepal (25.4%; 1.38 million households) reported having at least one member absent, that is, living outside of the country (CBS, 2012). This trend continued, with 4,457,828 individuals (15.3%) reported as absent from their homes in the 2021 census (NPHC, 2021), of whom 2,190,592 (7.5%) were living abroad (NPHC, 2021). Another important aspect of demographic change is the decline in average household size, aligning with the Second Demographic Transition (Karoll & Haase, 2009). Rural out-migration often takes form of chain migration, where initially the head of the family or a young, educated member moves to a city or seeks foreign employment, followed by other adults and, eventually, the entire family. The proportion of employed population in primary sector mainly in agriculture declined (NSO, 2014). Rural out-migration plays a crucial role in local land use and land cover change (Lambin & Meyfroidt, 2011). The rate of forest land degradation and increase in cropland has been very high since the 1970s. However, recently the forest land, in particular, is increasing in the middle of the country (Hill region and Siwalik), (Poudel et al., 2015) and decreasing the cropland in recent years. Forest cover has increased in the Hill and Siwalik zones as human activity decreases (Poudel et al., 2015). Nationally, forest cover rose from 39.99% in 2000 to 41.69% in 2019 (FRTC, 2022) and now over 46.8% (FRTC, 2024)

According to the census data, 34 districts of mid hill and mountain region are facing the negative (-) population growth (Gurung & Shrestha, 2024). This negative trend of population growth in these districts has growing impact on forest cover which is being increased due to the decrease in the crop land. The share of agricultural households fell from 73.9% in 2010/11 to 60.3% in 2022/23. The average size of agricultural landholdings has declined from 1.1 hectares in 1995/96 to 0.4 hectares in 2022/23. The proportion of holdings operating on less than 0.5 hectares increased from 40.1% in 1995/96 to 57.1% in 2022/23 (NSO, 2024).

Thus, the demographic shifts observed during past almost three decades are intrinsically linked to significant changes in land use and land cover (LULC) (Lambin & Meyfroidt, 2011). On the other hand, the national cropland, which is the catchy demand in Nepal' political economy decreased from 26.3% to 24.2% between 2000 and 2019, with declines recorded across all physiographic regions (FRTC, 2022).

The 2021 National Population and Housing Census reported that 41.4 % of Nepal's population lives in urban areas, up from just 17.1% a decade earlier (NSO, 2022). Rural out-migration is a key transformative process in agricultural regions of the developing world (Gray & Bilsborrow, 2014) and a significant driver of local land use and land cover change (Kates & Parris, 2003; Lambin & Meyfroidt, 2011; Seto et al., 2012). Some researchers argue that out-migration and remittances can undermine traditional agricultural activities, leading to land abandonment and the re-growth of native vegetation (Aide & Grau, 2004; Hecht, 2010).

According to NSO-Nepal, remittance is equivalent to 25.89% of the GDP (NSO, 2025). The country ranks fourth globally in terms of remittance-to-GDP ratio with total inflows reaching a record NPR 1.4 trillion (MoLESS, 2024). According to the report, approximately 35.6% of Nepali households receive remittances; however, 90.8% of these funds are prioritized for daily consumption (MoLESS, 2024; Sherpa, 2022). Contrary to this, the national cropland decreased from 26.3% to 24.2% between 2000 and 2019, with declines recorded across all physiographic regions (FRTC, 2022). The share of agricultural households fell from 73.9% in 2010/11 to 60.3% in 2022/23. The average agricultural landholding size dropped from 1.1 ha in 1995/96 to just 0.4 ha in 2022/23 (NSO, 2024). This study aims to explore the relationship between migration and their collective impact on the land use change in Nepal. The critical review on the relationship between migration and Land Use and Land Cover (LULC) can provide critical insights into the dynamics of land use transitions in case of Nepal.

2. The Study Area

Nepal is located in South Asia, bordered by China in the north, and by India in the east, south, and west. It has a total area of 147,181 km^2 and a population of 29.2 million in 2021. More than 86% of the total area of the country is occupied by mountains and only a small portion in the south is low-lying land known as Tarai. The altitude of the country ranges from less than 60m in the south to 8,848m on the summit of Mount Everest, the highest peak of the world. The government data shows that about 27% of the total area is

composed of cultivated land, followed by 39.6% forest, 12% pasture, 17.2% snow, ice and rock, and 2.6% water bodies (MoLRM, 2013).

Agriculture being the mainstay of the economy and accounting for one third of the GDP. Subsistence cereal production is still the mainstay of the crop sector in the mountain and hills of Nepal. The Tarai which has nearly 54 % cultivated land for cereal production has the largest share to Nepal's cereal production with nearly 60 %. The hill zone has 42% of the cultivated land and has the nearly 38% contribution of the cereal production. The Mountain has the least contribution in terms of cereal production, that is, only 3% with nearly 5 % productive land (MOALD, 2024).

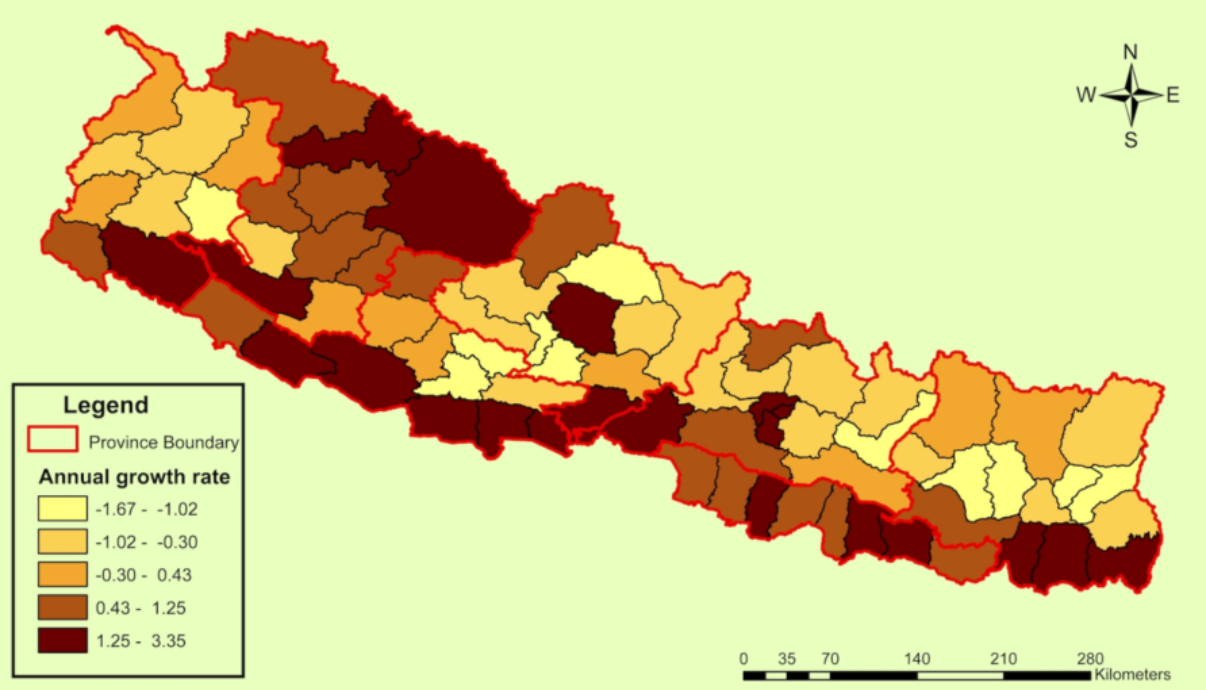

Figure 1: Map of the study area, Nepal: annual population growth rate by District

3. Conceptual Framework

We tried to triangulate between variables demographic parameters and land use change and land cover change. In this study migration is the major concern including the other demographic parameters. Mainly three ecological zones have taken to compare the population distribution and land use land cover change.

4. Materials and Method

The study framework adopted desk review for the collection of relevant information, data for population has been collected from the different records of National Statistics Office (NSO) and the information of land use and land cover change were collected from the different government documents. The collected population data and information and LULC has been analysed and finally established the linkage between population parameter and LULC.

5. Result

5.1 Population growth

The country's population started to grow rapidly with more than 2% annually till 2001 but it has started to drop afterward. The decline of the population growth was largely due to outflow of migrant workers from the country (Pathak & Lamichhane, 2014).

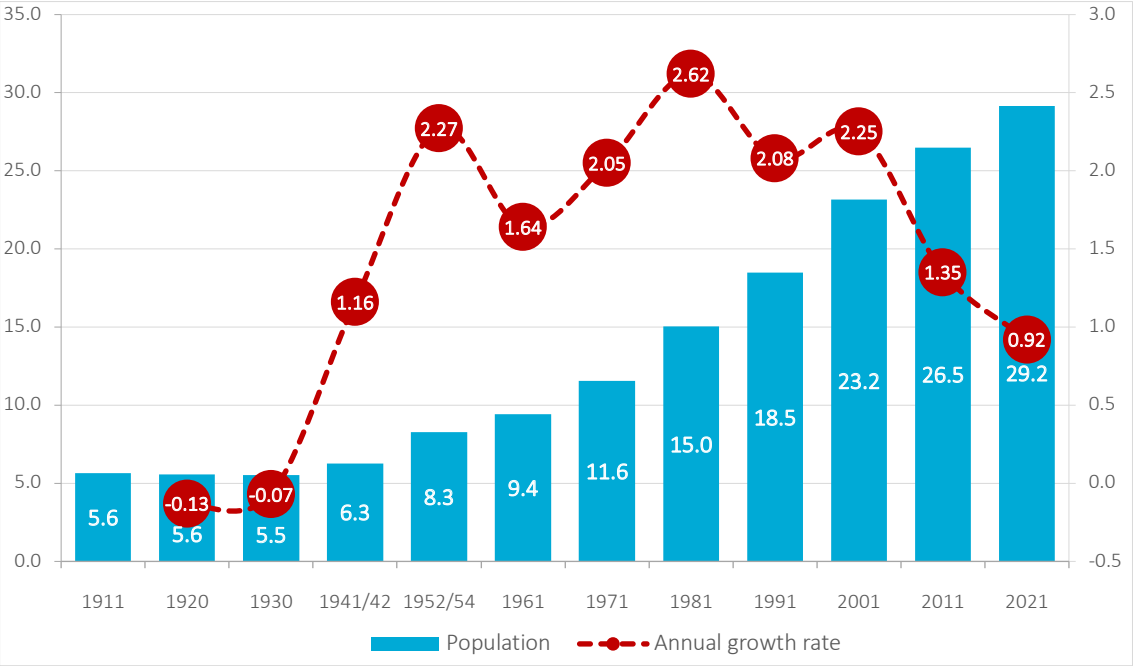

Figure 2: Population growth

5.2 Trend of population growth (Window of Opportunity)

Nepal is now at a stage of declining fertility which was preceded by a decrease in the mortality with in a relatively short span of time and it is positive outcome of the country's development. The most striking aspect of this overall process of change in the age structure and acceleration of the country's population. The country is experiencing a demographic dividend, as its working-age population is increasing more rapidly than the growth of total population. With the working-age population still growing faster than the total population, Nepal is currently in the prime position to reap the rewards of its demographic dividend before this trend reverses. Changes in age structure have potentially very important implications for macroeconomic performance especially for the optimum utilization of the resources.

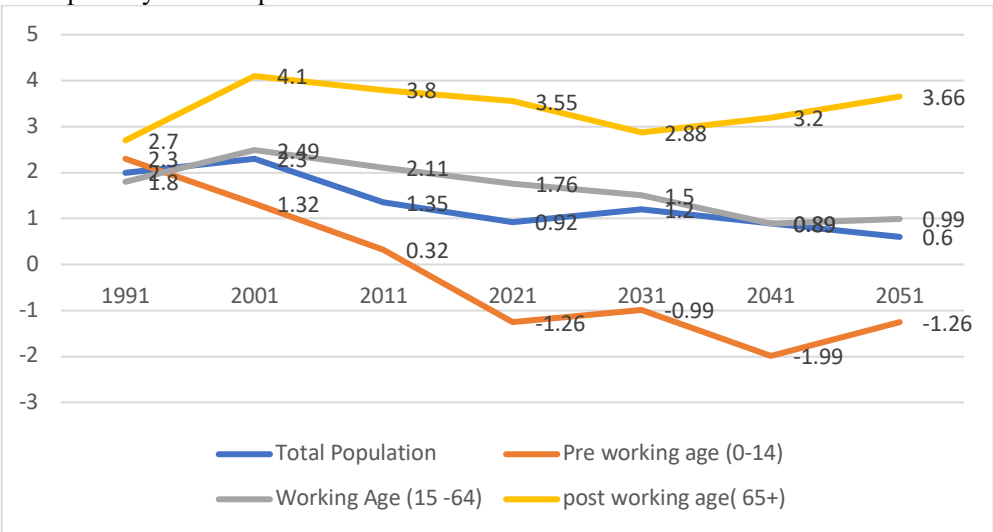

Figure 3: Demographic window of opportunity; population growth rates by working status, Nepal

5.3 Regional growth: Population growth by ecological zone

The population more than doubled from 11.56 million in 1971 to 29.16 million in 2021, with significant regional shifts. The national average annual growth rate fell sharply from 2.62% to 0.92%, reflecting a broader demographic slowdown, with particularly steep drops in the Mountain and Hill regions after 2001. These regions began to lose their proportionate share of the population, while the Tarai gained.

Table 1: Population growth by Ecological Region from 1971 to 2021

	Mountain	Hill	Mountain and Hill	Tarai	Nepal
Census Year					
1971	1,138,610	6,071,407	7,210,017	4,345,966	11,555,983
1981	1,302,896	7,163,115	8,466,011	6,556,828	15,022,839
1991	1,443,130	8,419,889	9,863,019	8,628,078	18,491,097
2001	1,687,859	10,251,111	11,938,970	11,212,453	23,151,423
2011	1,781,792	11,394,007	13,175,799	13,318,705	26,494,504
2021	1,772,948	11,757,624	13,530,572	15,634,006	29,164,578
Intercensal Change					
1971-1981	164,286	1,091,708	1,255,994	2,210,862	3,466,856
1981-1991	140,234	1,256,774	1,397,008	2,071,250	3,468,258
1991-2001	244,729	1,831,222	2,075,951	2,584,375	4,660,326
2001-2011	93,933	1,142,896	1,236,829	2,106,252	3,343,081
2011-2021	-8,844	363,617	354,773	2,315,301	2,670,074
Average Annual Growth					
1971-1981	1.35	1.65	1.61	4.11	2.62
1981-1991	1.02	1.61	1.52	2.75	2.08
1991-2001	1.57	1.97	1.91	2.62	2.25
2001-2011	0.54	1.06	0.99	1.72	1.35
2011-2021	-0.05	0.3	0.25	1.54	0.92

2021 census shows, the population distribution across its geographical regions shows a continuing shifts the Tarai. In 2021, the majority 53.61% lived in the Tarai, while 40.31% lived in the Hill region and 6.08% in the Mountain region. Compare to the 2011 census, this represents a clear trend: the Terai's share increased from 50.23% to 53.61%, while the Hill region's proportion decreased from 43.01% to 40.31, and the Mountain region's share also declined slightly from 6.73% to 6.08%. In summary, the population increasingly concentrating in the southern Tarai region.

Migration is one of the elements of population change in Nepal. The movement of people from hill and mountain to Tarai and rural to urban center as well as emigration abroad is common phenomenon in Nepal. Due to which, the growth rate of agricultural land expansion has different across the country's ecological, physiographic, and altitudinal regions, largely influenced by population dynamics and policy measures in Nepal. The status of agricultural land in Nepal has change significantly with the rapid population growth in the past (Poudel et al, 2018).

5.4 Regional shift in population distribution, Nepal, 1911-2021

As already mentioned, the shifting population distribution across Nepal's three ecological regions over five decades. The mountain region as consistently decreasing the share of the population, reflecting its sparse settlement. The Terai region experienced a steady increase in its population. And the hill region also consistently losing its proportionate share of the population.

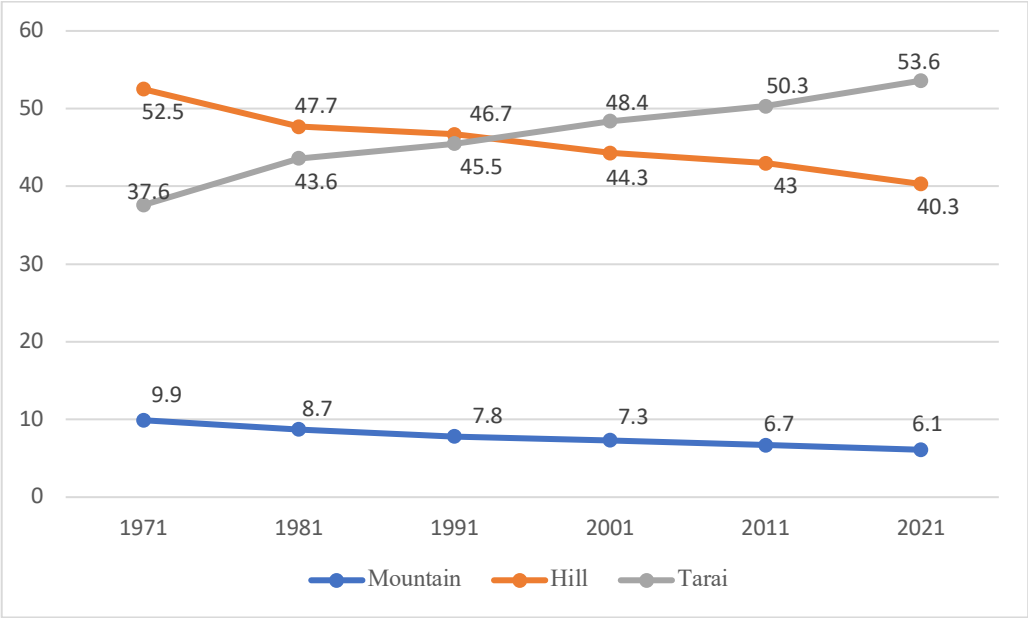

Figure 4: Regional Shift in Population Distribution, 1971-2021

Land is the primary resource of agrarian economies, Nepal is no exception. Agricultural land use over the past century has largely followed national population growth. Cropping systems and related trends, however, differ significantly by geography and climate. In the Tarai, rice, wheat, and maize are predominant. The Hill region focuses on maize and millet, alongside rice, wheat, and cash crops. In the Mountain region, buckwheat, barley, and potatoes are common, often combined with livestock rearing. Among Nepal's three ecological zones, the Tarai has the highest crop productivity due to its favourable location, fertile soil, and advantageous climate. That may be the reason of human migration are heavily directed towards the Tarai area. The heavily populated Terai and Siwalik regions have a high level of agriculture area.

5.5 Land area versus population by ecological zone, NPHC 2021

Population concentration in the Tarai despite its small land area, while the Mountain region is sparsely populated relative to its size.The Mountain region, despite covering a significant 35.2% of the land, is home to only 6.1% of the population. In contrast, the Tarai region accounts for just 23.1% of the total land but hosts the majority of the population at 53.6%. Meanwhile, the Hill region has the largest land share at 41.7% and contains 40.3% of the population, showing a relatively balanced ratio. Overall, the data highlights a heavy population concentration in the Tarai, while the Mountain region remains sparsely populated.

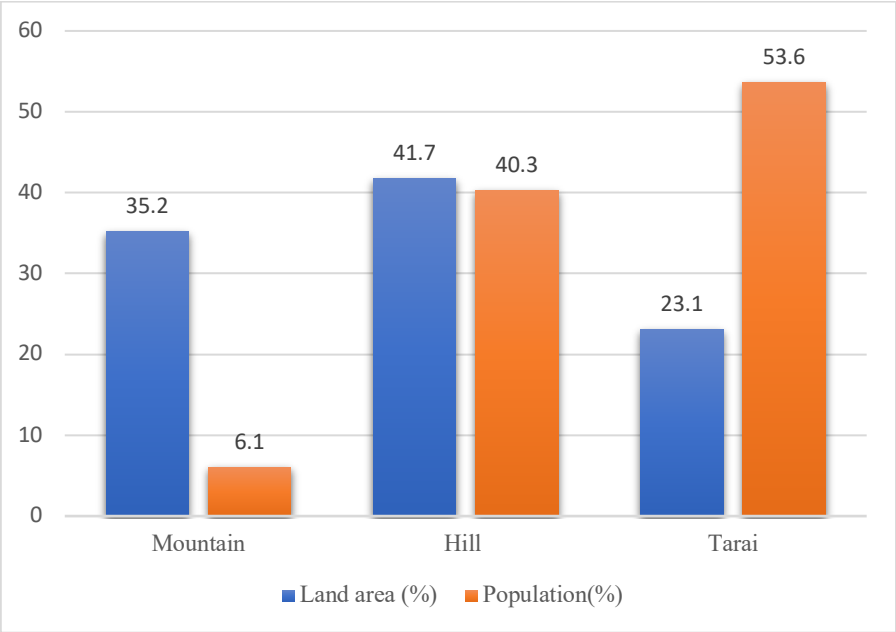

Figure 5: Land Area versus Population by Ecological Zone

Mountain and Hill region have the highest absentee rates (21.6% and 20%, respectively), reflecting significant out migration from hill and mountains. The densely populated Terai and Siwalik regions have a high level of agriculture area (Uddin et al., 2015). Which is the main pull factor of migration from the hill to Tarai.

Table 2: Absentee population within Country and Living Abroad

Area	Total Absentees			Absentees living within country	Absentees living abroad (as % of Total Population)
Ecological zone	Total	Male	Female		
Mountain	21.6	26.3	17.0	15.0	6.5
Hill	20.3	27.3	13.8	11.9	8.4
Terai	10.8	17.0	4.8	3.8	6.9
Nepal:%	15.3	21.7	9.1	7.8	7.5
Nepal: Absentee (n)	4,457,828	3,094,610	1,363,218	2,267,238	2,190,592
Nepal: total (N)	29,164,578	14,253,551	14,911,027	29,164,578	29,164,578

5.6 Historical Land Use and Land Cover Status

National level consolidated historical LULC periodic data is not available in the context of Nepal. In the national context the major types of land are forest land, cropland, grass land, snow/glacier cover land and urban areas. The changing status of those types of area has been reported in several studies carried out for different periods and using different methods.

The food crop production is considered as an expression of human effort to maximize the utilization of available land resource amidst increasing pressure of human number (Subedi, 2003). The Table no: 3 shows that forest is the primary land cover in Nepal, followed by cropland and grassland. In 2019, forest dominated with 41.69% of the total area, followed by cropland (24.21%) and grassland (13.27%). The remaining 20% of land cover comprised snow, bare rock, other wooded land (OWL), glacier, riverbed, built-up area, water body, and bare soil, in descending order. In 2000, forest also led with 39.99%, followed by cropland (26.31%) and grassland (13.95%), with the same categories occupying the remaining 20%. Between 2000 and 2019, forest cover increased by 1.7%, while OWL rose slightly from 3.57% to 3.62%.

Table 3: Land cover change between 2000 and 2019

	Area (2000)		Area (2019)	
Land cover	**Hectare**	**%**	**Hectare**	**%**
Water body	65824	0.44	71587	0.48
Glacier	464468	3.14	463872	3.14
Snow	576278	3.9	930199	6.29
Forest	5915518	39.99	6166766	41.69
Riverbed	170699	1.15	163721	1.11
Built-up	25487	0.17	78296	0.53
Cropland	3891500	26.31	3581047	24.21
Bare soil	156	0	4033	0.03
Bare rock	1091125	7.38	835030	5.64
Grassland	2064046	13.95	1963286	13.27
OWL	527915	3.57	535179	3.62
Total	**14793016**	**100**	**14793016**	**100**

Source: FRTC

The agricultural land rapidly expanded from 1910 to the 2010 in hill and Tarai region (Paudel et al., 2018) with the High population growth rate. But the population growth rate is slowing down in the country since the 2001 and the impact on LULC is site specific and started seen in the different way.

5.7 Land cover change in different ecological zone between 2000 and 2019

The Mountain region has 10 percent of its total area under cultivation in 2000. The corresponding proportions are 27.2 percent and 55 percent in the Hill and Tarai (Subedi, 2003). The Table no: 4 shows that between 2000 and 2019, forest cover increased in the Terai, Siwalik, and Middle Mountain regions, but decreased in the High Mountain and High Himal regions. Similarly, other wooded land (OWL) expanded in the Terai and Siwalik, while declining in the Middle Mountain, High Mountain, and High Himal. Cropland decreased across all physiographic regions. In contrast, built-up area gradually increased in every region. Grassland also declined in all areas except the High Mountain region, where it increased.

Table 4: Land Cover in different eco-physiographic region between 2000 and 2019

	Terai		Siwalik		Middle Mountain		High Mountain		High Himal	
Land cover (ha)	**2000**	**2019**	**2000**	**2019**	**2000**	**2019**	**2000**	**2019**	**2000**	**2019**
Water body	20195	23178	12358	14069	14897	17538	5005	4890	13370	11912
Glacier	0	0	0	0	0	0	57	57	464411	463815
Snow	0	0	0	0	0	2	7539	12152	568739	918046
Forest	373238	392240	1322210	1345929	2361959	2611307	1727499	1701021	130611	116269
Riverbed	87574	86691	61906	58383	17672	14928	949	796	2598	2922

Built-up	5561	24562	1794	9520	10323	28320	1648	6091	6160	9804
Cropland	1461951	1428152	377880	344532	1591882	1358332	456703	447024	3085	3007
Bare soil	0	108	0	28	0	9	0	24	156	3864
Bare rock	0	0	0	1	0	44	13958	12725	1077167	822259
Grassland	60406	46681	104579	85894	139343	114379	522467	555641	1237251	1160690
Owl	10026	17338	14880	37251	166191	157408	270888	266293	65930	56889
Total	2018951	2018950	1895607	1895607	4302267	4302267	3006713	3006714	3569478	3569477

Source: FRTC

6. Discussion

Migration as a catalyst for the changing landscape

The data shows Nepal is in the middle of the demographic dividend. The demographic dividends are not automatic; they depend on instructions and policies to transform change in population age structure into economic growth (Bloom and Canning, 2001). Population has unevenly distributed in different ecological zone. The socio-economic landscape of contemporary Nepal is increasingly defined by a dual reality: a structural reliance on global labor markets and a profound reconfiguration of domestic power dynamics within the rural household. Consequently, labor migration is now widely recognized as the structural backbone of the nation (Knerr, 2017). This is evidenced by the fact that Nepal ranks fourth globally in terms of remittance-to-GDP ratio at 33.1%, with total inflows reaching a record NPR 1.4 trillion (MoLESS, 2024). This phenomenon is profoundly gendered; despite a slight increase in female participation, men accounted for 87.1% of the 741,297 labor approvals issued in the 2023/24 fiscal year. Consequently, migration is not merely a demographic shift but a socio-economic catalyst that has created a massive population of "left-behind" women who manage the domestic and agricultural spheres in a "husband-absent" household (MoLESS, 2024; Sherpa, 2022). While 35.6% of Nepali households receive remittances, the Nepal Labour Migration Report 2024 and Sherpa (2022) both highlight that these funds are overwhelmingly prioritized for daily consumption (90.8%) and loan repayment (13.5%).

In Nepal, farmers continue to leave the less fertile hillside terraces to move to nearby and further away valley bottoms, Terai or urban areas (Sudmeier-Rieux, K., 2016). With at least one third of all Nepali households which have at least one member working and living abroad, Nepal is one of the world's most remittance-dependent countries (United Nations Nepal Information). Nepal has experiencing an increasing volume of internal migration since of malaria in the Terai and Inner Tarai areas in the early nineteen-fifties. The mountain and hill zones has been losing their proportionate share of population whereas Terai had been gaining this share. Prior to 1991, largest share of population was in the hill. However, according to the population census 2021, the largest share of population is in Terai followed by hill and mountain respectively. Nepal's migration pattern has changed in the last 30 years.

Land is the primary resource in Nepal. The land use and land cover status in Nepal is relevant to research into cropland evolution, forest and grassland, snow/glacier cover change and urban land expansion which have to link with the demographic parameters especially migration. This study aimed to review demographic indicator in relation to the available LULC research and documents in Nepal. This highlights shows how mobility is a key dynamic in the complex interactions between natural processes and anthropogenic action. Migration and land use change are intrinsically linked. In rural developing regions, households typically utilize a variety of assets to invest in a diverse portfolio of livelihood activities, encompassing subsistence agriculture, cash cropping, wage labor, and migration (Ellis, 2000). Migration often serves as a household strategy to diversify income sources through migrant remittances (Stark & Bloom, 1985). Remittance contributes to improve household consumption (Qin, 2010; Maharjan et al, 1013) rather than the household level capital formation in rural study areas. The fundamental characteristic of the rural out-migration is the structural shifts in employment from agricultural sector to the non-agricultural sector such as internal and international remittance and business etc.

Fundamentally, land use change is closely related to human-environment interactions, reflecting the dynamic relationship between human activities and the physical environment. Land use change varies across different locations due to differing demographic and economic conditions (Li, 2011).

According to the Nepal Living Standard Survey 2022/2023, the percentage of agriculture households has gradually decreased, continuously dropping since 1995 and dropping from 73.9 percent in 2010/11 to 60.3 percent in 2022/23. This indicates that primary livelihood shifted away from agriculture. Similar is the case with the average size of agricultural land, which has also declined consistently, from 1.1 hectares in 1995/96 to just 0.4 hectares in 2022/23. On the other hand, the proportion of holdings operating less than 0.5 hectares has been increasing consistently, from 40.1 percent in 1995/96 to 57.1 percent in 2022/23. This trend indicates fragmentation of landholdings, resulting in potential challenges for efficient agricultural practices and difficulties in achieving economies of scale. It is also observed that rural out migration, low productivity, human wildlife conflict, labour intensive agricultural work especially in mountain and hill, are the main reason of land abandonment.

7. Conclusion

Nepal is undergoing a fundamental demographic transformation characterized by slowing population growth, large-scale out-migration, and a profound regional redistribution of people. Realizing the potential of this transition requires integrated policies that address demographic shifts and ensure sustainable land management across all ecological zones. Population and its parameters now has a significant influence in Nepal's society. The population has more than doubled over five decades, but annual growth has fallen below 1%, signalling a demographic slowdown. The migration shapes the distribution of population in the different ecological zone of the country. The Mountain and Hill regions are losing their population share, while the Tarai now hosts a majority of the country's people despite having the smallest land area. Agriculture in Mountain region is heavily dependent as subsistence-based contributing a smaller percentage to the national cereal production indicating to enhance food security and agricultural income in this region (World Bank, n.d.). The larger number of the absentees are dominant by male and from the uplands. The remittances have become economically vital for the country, yet the rural livelihoods are shifting away from agriculture. The migration is driving for visible land use changes, including forest regrowth in the hills and declining cropland, alongside increasing fragmentation of landholdings. Nepal currently stands at the peak of its demographic dividend window, but it has been realizing its potential requires integrated policies that address the dual challenges of depopulating uplands, urbanizing lowlands, and sustainable land management in a context of profound mobility and transition. From the situation analysis of population and land cover and land use in Nepal implies that there is a need of regulation of population with ecological, social and economic sustainability. Moreover, sound economic policies capable to addressing the demographic dividends and land use according to the interregional sustainable management of the country.

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